

## Taxonomy of the Genus *Chlorophanus* Sahlberg (Curculionidae, Coleoptera) in Korea

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**Abstract** Three species of the genus *Chlorophanus* Sahlberg are recognized and one species is questionable species from Korea. Among them, *Chlorophanus planus* Gyllenhal is reported for the first time from Korea. External and genital characteristics for the species is redescribed and illustrated. Key to the species are provided. Sexual dimorphic variations are described and illustrated.

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**Key words** *Chlorophanus*, Curculionidae, Coleoptera, taxonomy, Korea

### INTRODUCTION

The genus *Chlorophanus* Sahlberg was established by Sahlberg (1823), Schoenherr (1823) and Germar (1824). The name by Sahlberg (1823) was placed on the Official List of Generic Names in Zoology in 1991 (Alonso-Zarazaga, 1999). The genus is a group of Tanymericini, adleognathi, Curculionidae (Lacordaire, 1863; Morimoto, 1962a). Three species of the genus have been reported in Korea: *Chlorophanus grandis* Roelofs by Faust (1887: 27), *C. sibiricus* Gyllenhal by Faust (1887: 27), and *C. auripes* by Kôno (1928: 166). *Chlorophanus sibiricus* Gyllenhal is a questionable species for the distribution in South Korea. Most of specimens reported as *C. sibiricus* Gyllenhal from Korea were reidentified, and it is considered to *C. grandis* Roelofs. There was no description for the *C. sibiricus* in Faust (1887) although he had reported the species from Korea firstly. Kôno (1928, 1930) and most of taxonomists in Korea determined *C. grandis* Roelofs and *C. sibiricus* Gyllenhal based on the state of posterior joint part of the elytral interval 2nd and 10th, but the character state is unstable. Therefore, characters treated by Faust (1897) and Kôno (1930) were analysed, and key and descriptions to the species of the genus are presented in this paper.

All the species of the genus *Chlorophanus* Sahlberg show the sexual dimorphic characters distinctly.

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## MATERIALS AND METHODS

Specimens for this study are deposited in Korea University (KU, Seoul, Korea), National Institute of Agricultural Science and Technology (NIAT, Suwon, Korea), and Zoological Institute Russian Academy of Science (ZIRAS, st. Petersburg, Russia).

Abbreviations for provinces: CB (Chungcheongbuk-do), CN (Chungcheongnam-do), GB (Gyeongsangbuk-do), GG (Gyeonggi-do), GN (Gyeongsangnam-do), GW (Gangwon-do), JB (Jeollabuk-do), JN (Jeollanam-do), JJ (Jeju Island).

Measurements for the parts of body: Body length—from the anterior margin of pronotum to the end of elytra (head length was excluded in the body length, the measuring point of apex is indistinct because of drooping the head); Body width—the widest part of elytra (elytra always wider than the other parts of body); Head length—from the apex of rostrum to the posterior margin of hind head, but the length was slightly variable because of covered parts of hind head with prothorax; Head width—the widest part of head; Rostrum length—from the apex of epistomal plate to the base of rostrum (anterior margin of eye); Rostrum width—the base of rostrum; Frons width—the part between eyes; Eye width—the vertical length; Antennal scape length—from the connected margin with socket in scrobe to the distal margin of scape; Antennal funicle length—from the connected margin with socket in scape to the distal margin of 7th segment; Length of each funicle segment—from the connected margin with former segment to its distal margin.

## TAXONOMY

### **Genus *Chlorophanus* Sahlberg, 1823** 청바구미속 (신칭)

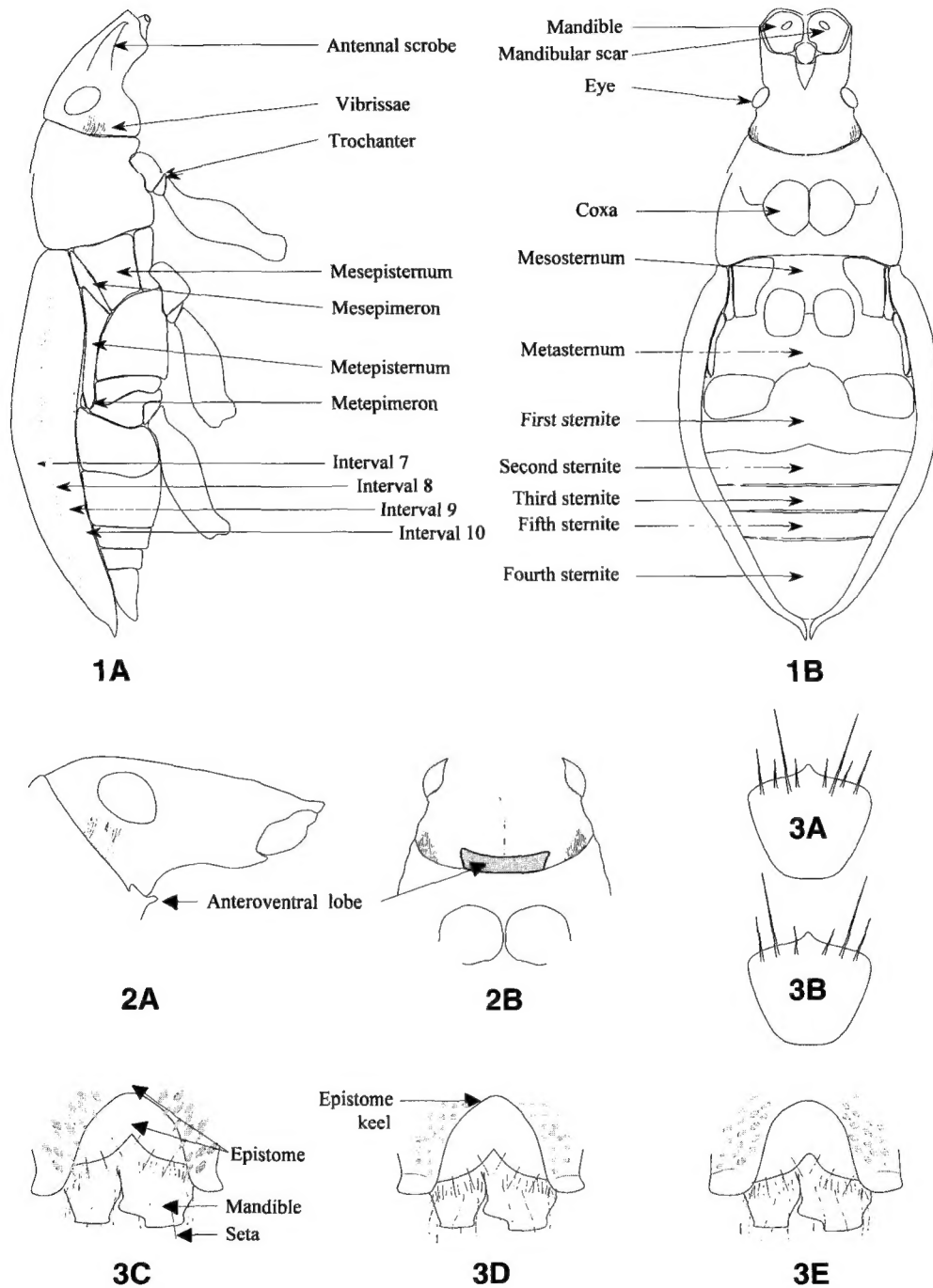
*Chlorophanus* Sahlberg 1823: 24; Alonso-Zarazaga and Lyal, 1999: 178; Hong *et al.*, 2000: 181.

[Type-species: *Chlorophanus fallax* Sahlberg, 1923 = *Curculio excisus* Fabricius, 1801]

*Chlorophanus* Schoenherr, 1823: 1136 (non Sahlberg, 1823).

*Chlorophanus* Germar, 1824: 440 (non Sahlberg, 1823, nec Schoenherr, 1823); Reitter, 1915: 171; Kôno, 1930: 180; Morimoto, 1962a: 54, 1962b: 214; Chao et Chen, 1980: 72; Zherikhin *et al.*, 1996: 305.

**Diagnosis.** Prementum with 6–8 setae. Mandible with deciduous cusp and scar, with many (over 5) long setae and many short hair-like setae, without scales. Basal part of mandibular scar column-like and projected. Mandibular motion horizontal. Rostrum short, robust, with a mid-longitudinal keel, without a transverse groove between frons. Epistomal keel broad U-shape, obtuse angle, not raised. Anterior margin of epistomal plate with 3–4 pairs of setae. Epistomal plate without scales. Length of antennal scape between anterior margin and posterior margin of eye. Tarsus 5 segmented, and the 4th segment small. Corbels of hind tibia narrowly enclosed. Base of claws free, separate together. Suture between metepisternum and metasternum distinct. Metepisternum covered narrowly with elytra, without groove or



**Figs 1-3.** General shape, basal part of head and prothorax, and Prementum. Fig. 1A-B. General shape. 1A. Lateral view; 1B. Ventral view (*Chlorophanus grandis* Roelofs, female). Fig. 2A-B. Basal part of head and prothorax. 2A. Lateral view; 2B. Ventral view (*Chlorophanus grandis*, male). Fig. 3A-E. Prementum and male epistomae. 3A. 8 setae in *C. grandis* and *C. planus*; 3B. 6 setae in *C. auripes*; 3C. *C. grandis*; 3D. *C. auripes*; 3E. *C. planus*.

keel. Scutellum V-shape. Elytra with rectangular humeri, behind of shoulder part straight. Basal margin of elytra not raised and weakly projected anteriorly. Intervals of elytra not costate, anterior part of interval 2-4 tumid. Erected setae on each interval short hair-like, shorter than 1/2 width of 2nd interval, arranged many rows (3-5) alternatively. Striae on the elytra indistinct. Puncture deep or shallow, circular sharpened posteriorly. End of elytra narrow and pointed, acute angle. Hind wing functional to fly. Anterior margin of 2nd sternite strongly bisinuate. 2-4 sternites stairs-shape, flat to slightly rounded. Posterior margin of 2-4 sternites straight. Middle width of 2nd sternite as wide as 3rd+4th sternite. Middle width of 5th sternite as wide as 3rd+4th sternite. Body with greenish scales densely.

*Sexual dimorphism.* Apex of rostrum side projected and with anteroventral lobe of thorax (excluding *C. planus*), in male. In female, mucro of the apex of middle tibia longer than that of male. Venter is more tumid in female than male. Posterior margin of 5th ventrite truncate in male, rounded in female.

*Distribution.* Whole Palaearctic.

#### Key to the species of genus *Chlorophanus* from Korea

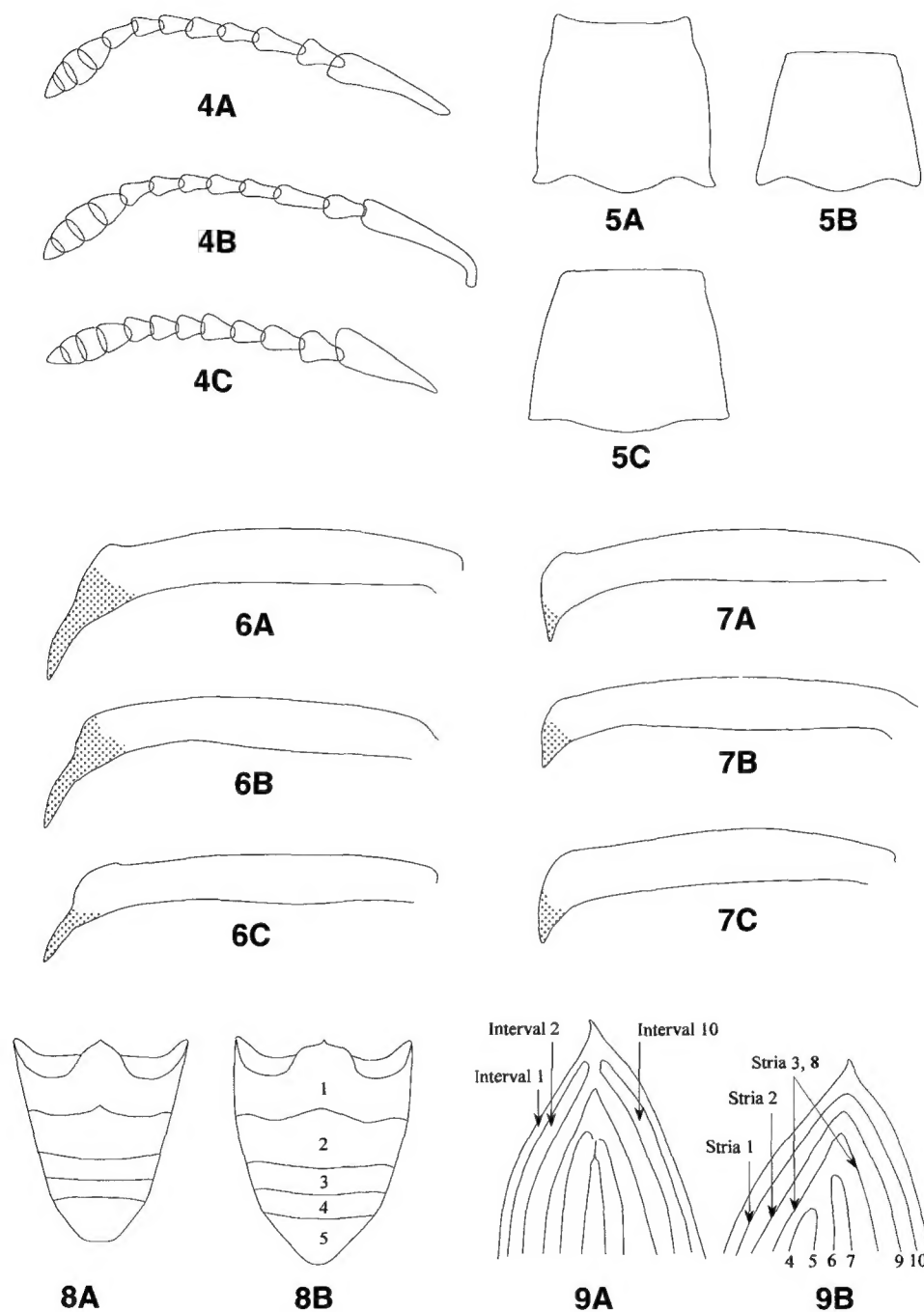
1. Yellow scales absent on the sides of prothorax and 8th interval of elytron. Side of pronotum narrowed from base to middle part to front part more and more. First segment of funicle shorter than 2nd segment, 3rd segment longer than 4th segment ..... *Chlorophanus auripes* Faust
- Yellow scales present on the sides of prothorax and 8th interval of elytron covered with yellow scales ..... 2
2. Antennal segments long, slender. First segment of funicle shorter than 2nd segment, 3rd segment longer than 4th segment. .... *Chlorophanus grandis* Roelofs
- Antennal segments short, stubby. First segment of funicle as long as 2nd segment, 3rd segment as long as 4th segment ..... 3
3. Side of pronotum base to middle part parallel and slightly narrowed to front part, pronotum wrinkles perceptible, basal margin strongly bisinuate ..... [*Chlorophanus sibiricus* Gyllenhal, Russian species]
- Side of pronotum narrowed from base to middle part to front part more and more. Pronotum wrinkles imperceptible, basal margin weakly bisinuate ..... *Chlorophanus planus* Gyllenhal

#### ***Chlorophanus auripes* Faust, 1897 홍다리청바구미**

(Figs 3B, 3D, 4B, 5B, 6B, 7B, 10B, 11B)

*Chlorophanus auripes* Faust, 1897: 94; Kôno, 1928: 166; Kôno, 1930: 183; Haku, 1936: 122; Kôno et Kim, 1937: 19; Mochizuki et Tsunekawa, 1937: 88; Motschizuki et Masui, 1939: 71; Ishii, 1940: 54; Cho, 1957: 277; Kim et al., 1974: 228; Chao et Chen, 1980: 74; Kwon et Lee, 1986: 70; Hong et al., 2000: 181. [Type-locality: Chanka-See, China]

*Description.* Body length 8.3-8.6 mm, body width 3.9-4.1 mm. Premetum with 6 setae. Just behind area of epistomal keel with greenish metallic circular scales densely. Apex of rostrum as wide as base. Antennal length shorter than half of body length. Antennal scape length shorter than funicle, exceed anterior margin of eye and not exceed posterior margin of eye. Antennal scape from base to middle part thick, distal part weakly clavate. Antennal scape without scales, with lancet-like or short hair-like setae densely. Antennal funicle 3-6 segments slender elongate form. Antennal funicle without scales, with few



**Figs 4-9.** External characters of *Chlorophanus* spp. Fig. 4A-C. Antennae. 4A. *C. grandis*; 4B. *C. auripes*; 4C. *C. planus*. Fig. 5A-C. Pronotum. 5A. *C. grandis*; 5B. *C. auripes*; 5C. *C. planus*. Fig. 6A-C. Mucro of the middle tibiae in female. 6A. *C. grandis*; 6B. *C. auripes*; 6C. *C. planus*. Fig. 7A-C. Mucro of the middle tibiae in male. 7A. *C. grandis*; 7B. *C. auripes*; 7C. *C. planus*. Fig. 8A-B. Venter. 8A. *C. grandis* male; 8B. *C. grandis* female. Fig. 9A-B. Elytral end of *Chlorophanus grandis*. 9A. *sibiricus* type; 9B. *grandis* type.

long setae and with short hair-like setae densely. First segment of antennal funicle shorter than 2nd, 3rd segment longer than 4th segment. Antennal club spindly, narrower than 2 times of width of 6th funicle. Frons wider than 2/3 width of rostrum, wider than 1.5 times of eye width, anterior part flat. Eye lateral position, oblique, convex. Pronotum trapezoid, flat, with a broad shallow mid-longitudinal groove, posterior margin strongly bisinuate, pronotum disc integuments strongly sculptured and wrinkled. Vibrissae present. Femur with circular greenish or reddish copper metallic scales densely. Tibia with circular greenish or reddish copper metallic scales densely. Inside of fore tibia sinuate to strongly curved inward through distal part, apex of fore tibia rounded inward. Elytra covered with greenish circular scales densely and with yellowish dust-like incrustation. Elytra without yellow stripe on 8th interval.

*Material examined.* [KU] [GG] Cheolwon, Kangseo-ri, 1 ♂, 1 ♀, 21 VIII 1967 (J.I. Kim); Mt. Cheonmasan, 1 ♀, 10 VIII 1980 (S.H. Nam); Nanzan-S (= Namsan), 1 ♂, 26 VII 1933 (S. Eguchi); Seoul, 1 ♂, ? (?); Seoul, 1 ♂, 1 ♀, 15 IX 1961 (J.I. Kim); Seoul, Yongsan-gu Hanganggosubuji, 1 ♀, 24 VIII 1997 (D.Y. Jeong); Seoul, Seokhwa-dong, 1 ♀, 30 VIII 1967 (C.H. Kim). [CB] Mt. Sokrisan, 1 ♀, 1 VIII 1957 (J.S. Kim). [?] ? , 1 ♀, 29 VI 1915 (?); ? , 1 ♀, 18 VI 1913 (?). [ZIRAS] [GG] Seoul, 1 ♀, 30 VII 1938 (?).

*Distribution.* Korea, Japan (Honshu), China (Beijing, Hebei, Shanxi, Inner Mongolia, Gansu), East Siberia.

### ***Chlorophanus grandis* Roelofs, 1873 황초록바구미**

(Figs 1, 2, 3A, 3C, 4A, 5A, 6A, 7A, 8, 9, 10A, 11A)

*Chlorophanus grandis* Roelofs, 1873: 162; Faust, 1887: 27; Okamoto, 1924: 186; Kôno et Kim, 1937: 28; Motchizuki et Tsunekawa, 1937: 88; Ishii, 1940, 54; Cho, 1947: 66; Cho, 1963: Cho *et al.*, 1968: 263; Kim *et al.*, 1974: 228; Kwon et Lee, 1986: 70; Bae et Moon, 1993: 148; Paik *et al.*, 1995: 429; Kim et Kim, 1996: 131. [Type-locality: Yokohama, Japan]

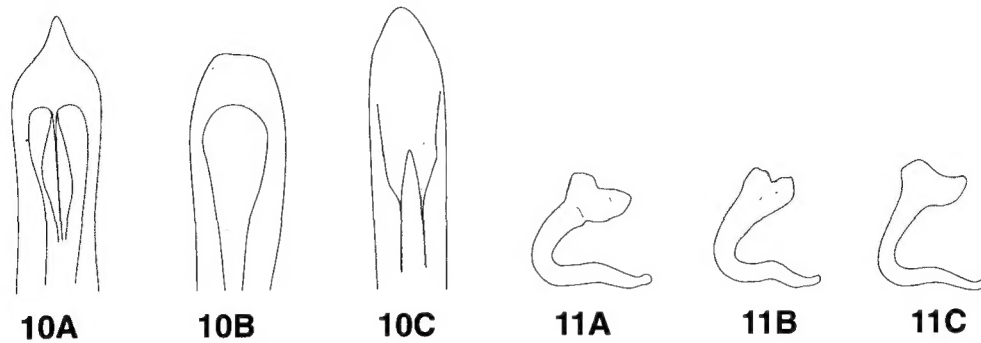
*Chlorophanus grandis* var. *lugubris* Sharp, 1896: 111; Kôno, 1930: 182.

*Chlorophanus grandis* var. *metallescence* Sharp, 1896: 111, Kôno, 1930: 182.

*Chlorophanus grandis* f. *konumensis* Kôno, 1930: 182.

*Chlorophanus rugicollis* Kôno, 1930: 182.

*Description.* Body length 8.41–8.73 mm, body width 4.12–4.25 mm. Premetum with 8 setae. Just behind area of epistomal keel with greenish metallic circular and lancet-like scales densely. Antennal scape without scales, with narrow lancet-like or short hair-like setae densely. Antennal funicle 3–6 segments slender elongate form. Antennal funicle without scales, with few long setae and with short hair-like setae densely. First segment of antennal funicle shorter than 2nd, 3rd segment longer than 4th segment. Antennal club spindly, narrower than 2 times of width of 6th funicle. Frons wider than 2/3 width of rostrum, wider than 1.5 times of eye width, anterior part flat to weakly depressed. Eye lateral position, oblique, convex. Pronotum trapezoid, with a weak mid-longitudinal keel around which slightly depressed, posterior margin strongly bisinuate, pronotum disc integuments sculptured and strongly wrinkled. Vibrissae present. Femur with circular greenish or reddish copper metallic scales densely. Tibia with circular greenish or reddish copper metallic scales densely. Inside of fore tibia sinuate to strongly



**Figs 10-11.** Aedeagus and spermatheca. Fig. 10A-C. Ventral view of aedeagus. 10A. *C. grandis*; 10B. *C. auripes*; 10C. *C. planus*. Fig. 11A-C. Spermatheca. 11A. *C. grandis*; 11B. *C. auripes*; 11C. *C. planus*.

curved inward through distal part. Apex of fore tibia rounded inward. Inside of hind tibia with long light brown bristles. Elytra with yellow stripe on 8th interval and side of prothorax. Elytra covered with greenish circular scales densely and with yellowish dust-like incrustation.

**Remarks.** *Chlorophanus grandis* is similar to *C. sibiricus*, with yellow stripe on 8th interval of elytra and side of prothorax. There was no compared data between *C. grandis* and *C. sibiricus* in Roelofs's description (1873). Characters described by Faust (1897) were ambiguous to separate *C. grandis* and *C. sibiricus*. Kôno (1928, 1930) and many Korean taxonomists identified *C. grandis* Roelofs and *C. sibiricus* Gyllenhal based on the character state of posterior joint part of the elytral interval 2nd and 10th. However, the character state is unstable (Fig. 9).

**Material examined.** [KU] [GG] Cheongpyeong yuwonji, 1 ♂, 29 V 1984 (S.H. Gang); 1 ♂, 27 V 1984 (J.Y. Won); Gangseo-ri, 1 ♂, 21 VII 1967 (J.K. Oh); Mt. Cheonmasan, 1 ♂, 27 V 1984 (I.S. Hyeon); Mt. Cheonggyesan, 1 ♂, 24 VI 1984 (Y.M. Kim); 1 ♀, 23 V 1984 (S.G. Kim); Aengmubong Bokwangsa, 1 ♀, 15 VI 1984 (Y.H. Go); Seoul Cheongryangri, 1 ♀, 23 V 1909 (?). [GW] Mt. Odesan, 1 ♂, 24 VI 1998 (T.M. Han and T.H. Gang); 1 ♀, 17 VII 1962 (Sim); Pyeongchang Doam-myun Yongsan-ri, 1 ♂, 29 VI 1985 (J.H. Lee); Yanggu Haeon-myeon, 2 ♂, 13 VI 1990 (J.I. Kim); Hongcheon Gachilbong, 1 ♀, 21-23 VI 1984 (H. N. Kim); Gachilbong, 1 ♀, 21-23 VI 1984 (J. Suk); Hwacheon Damok-ri, 1 ♂, 28 V 1976 (C.G. Kim); Susang-ri, 1 ♀, 12 VI 1990 (J.I. Kim). [CB] Cheongwon, 1 ♀, 24 V 1992 (?). JN Mt. Jirisan Baekmudong, 1 ♀, 28 VII 1992 (K. Han). [?] ?, 1 ♀, 20 V 1909 (?); ?, 1 ♀, 16 VII 1920 (?). [North Korea] [HN] Keizanchin Kannanc, 1 ♀, 9 VII 1938 (S. Eguchi). [NIAS] [GG] Suigen, 1 ♂, 1 ♀, 19 VI 1925 (Muramatsu). [GW] Hongcheon-gun Tegol, 2 ♀, 25 VII 1997 (K.J. Hong); Samcheok Hajum-ri, 1 ♀, 28 V 1993 (D.S. Ku).

**Distribution.** Korea, Japan (Hokkaido, Honshu, Kyushu).

### ***Chlorophanus sibiricus* Gyllenhal, 1834 청바구미**

*Chlorophanus sibiricus* Gyllenhal, 1834: 65; Faust, 1887: 27; Kôno, 1930: 183; Chao et Chen, 1980: 73-74. [Type-locality. Dauria]

*Description.* Body length 8.38–8.64 mm, body width 4.03–4.17 mm. Premetum with 6 setae. Just behind area of epistomal keel with greenish metallic circular and lancet-like scales densely. Apex of rostrum as wide as base. Antennal length shorter than half of body length. Antennal scape length shorter than funicle, exceed anterior margin of eye and not exceed posterior margin of eye. Antennal scape from base to middle part thick, distal part weakly clavate. Antennal scape without scales, with narrow lancet-like setae densely. Antennal funicle without scales, with few long setae and with short lancet-like setae densely. First segment of antennal funicle as long as 2nd, 3rd segment as long as 4th segment. Antennal club short spindly, narrower than 2 times of width of 6th funicle. Frons wider than 2/3 width of rostrum, wider than 1.5 times of eye width, without transverse groove in front of eye, anterior part flat. Eye lateral position, oblique, round to convex. Pronotum trapezoid, mid-longitudinal keel indistinct slightly depressed like as mid-longitudinal groove, posterior margin strongly bisinuate, pronotum disc integuments strongly wrinkled. Vibrissae present. Femur with circular greenish metallic scales densely. Tibia with circular greenish metallic scales densely. Fore tibia thick. Inside of fore tibia sinuate to strongly curved inward through distal part. Apex of fore tibia rounded inward. Inside of hind tibia with long light brown bristles. Elytra with yellow stripe on 8th interval and side of prothorax. Elytra covered with greenish circular scales densely and with yellowish dust-like incrustation. Intervals of elytra not costate, anterior part of interval 2–4 tumid. Erected setae on each interval short hair-like, shorter than 1/2 width of 2nd interval, arranged many rows (3–5) alternatively. Striae on the elytra indistinct. Functure deep or shallow, circular sharpened posteriorly. End of elytra narrow and pointed, acute angle. Anterior margin of 2nd sternite strongly bisinuate. 2–4 sternites stairs-shape, flat to slightly rounded. Posterior margin of 2–4 sternites straight. Middle width of 2nd sternite as wide as 3rd + 4th sternite. Middle width of 5th sternite as wide as 3rd + 4th sternite.

*Remarks.* This species is similar to *C. grandis*, but they can be differentiated by the antennal segments: *Chlorophanus grandis* have short stubby antennal segments; First segment of funicle as long as 2nd segment; Third segment as long as 4th segment. It is reconfirmed that materials reported as *C. sibiricus* from South Korea are *C. grandis*.

*Material examined.* [KU] [Russia] Tuva Pos. Erzin Step Art. frigid naufe r. Tegkhen, 1 ♂, 1 ♀, 27 VII 1980 (B. Korotyaev).

*Distribution.* Korea ?, China (Beijing, Hebei, Shanxi, Shaanxi, Inner Mongolia, Ningxia, Gansu, Qinghai, Sichuan), Mongolia, Russia (Maritime Territory, Siberia).

### ***Chlorophanus planus* Sharp, 1896 꼬마청바구미 (신칭)**

(Figs 3A, 3E, 4C, 5C, 6C, 7C, 10C, 11C)

*Chlorophanus planus* Sharp, 1896: 111; Kôno, 1930: 181; Morimoto, 1962b: 214. [Type-locality. Nikko Japan]

*Description.* Body length 7.56–8.21 mm, body width 3.78–4.15 mm. Premetum with 8 setae. Just behind area of epistomal keel with greenish metallic semicircular scales densely. Apex of rostrum as wide as base. Antennal length shorter than half of body length. Antennal scape length shorter than funicle, exceed anterior margin of eye and not exceed posterior margin of eye. Antennal scape from base to



middle part not slender, distal part weakly clavate. Antennal scape without scales, with lancet-like or short hair-like setae densely. Antennal funicle 3–6 segments monilliform. Antennal funicle without scales, with few long setae and with short hair-like setae densely. First segment length of antennal funicle as long as 2nd, 3rd segment as long as 4th segment. Antennal club short spindly, narrower than 2 times of width of 6th funicle. Frons wider than 2/3 width of rostrum, wider than 1.5 times of eye width, anterior part flat. Eye lateral position, oblique, convex. Pronotum trapezoid, flat, without wrinkles, with a weak mid-longitudinal keel around which slightly depressed, posterior margin weakly bisinuate, pronotum disc integuments sculptured weakly. Femur with circular greenish metallic scales densely. Tibia with circular greenish or reddish copper metallic scales densely. Fore tibia thick. Inside of fore tibia sinuate to strongly curved inward through distal part. Apex of fore tibia rounded inward. Inside of hind tibia with long light brown bristles. Elytra with yellow stripe on 8th interval and side of prothorax. Elytra covered with greenish circular scales densely and with yellowish dust-like incrustation.

*Diagnosis.* Funicle very short and stubby. Pronotum wrinkled weakly, base weakly bisinuate. Elytra with yellow stripe on 8th interval and side of prothorax.

*Remarks.* Sharp (1896) mentioned that this species is readily distinguished from *C. grandis* by the characters mentioned above as well as by being only half the size, and by having the yellow stripe of the elytra extending over two interstices instead of one. The male has the chin-piece (anteroventral lobe of prothorax) of the prosternum not perceptibly developed. The female has the tibial mucro much longer than they are in the male. New to Korean fauna.

*Material examined.* [KU] [GG] Yangsu-ri, 1 ♂, 6 VI 1977 (Y.H. Suk); Seoul, 1 ♀, ? VIII 1929 (F.S. Cho); ?, 1 ♂, 19 V 1966 (Y.D. No).

*Distribution.* Korea, Japan (Honshu, Shikoku).

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